中国中车 CRRC

产品数据手册 Product Datasheet 版本 Ver.1910

TG820FF08S3-S4A01

六单元 IGBT 模块 Six-Pack IGBT Module

关键参数 Key Parameters

V_{CES}		750	V
$V_{CE(sat)}$	Typ.	1.25	V
I_C	Max.	820	A
$I_{C(RM)}$	Max.	1640	A

典型应用 Typical Applications

●电动汽车	Automotive Applications
●混合动力/纯电动车	Hybrid/Electrical Vehicles
●电机驱动	Motor Drives

特点 Features

●铜针翅基板	Cu pin-fin Baseplate
●低开关损耗	Low Switching Losses
● 750V 额定电压	Blocking Voltage 750V
●低感设计	Low Inductive Design

电路结构 Circuit Configuration

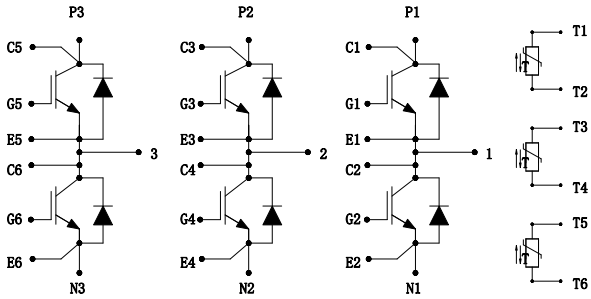


图 1.电路结构

Fig. 1 Circuit configuration

模块外形 Module Appearance

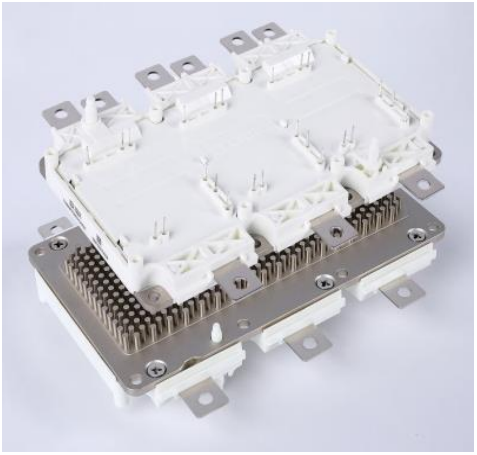


图 2. 模块外形

Fig. 2 Module appearance

模块标签说明 Module Label Code Instruction

数据位置 Data position	数据内容 Content of data
1--8	模块批次号 Module batch number
9--12	模块序列号 Module serial number

最大额定值 Absolute Maximum Ratings

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	数值 Value	单位 Unit
V_{CES}	集电极-发射极电压 Collector-emitter voltage	V_{GE} = 0V, T_C= 25 °C	750	V
V_{GES}	栅极-发射极电压 Gate-emitter voltage	T_C= 25 °C	± 20	V
I_C	集电极电流 Collector-emitter current	T_F= 80 °C，T_{vj}max = 175°C	450	A
	额定电流 Rating Current		820	A
$I_{C(RM)}$	集电极峰值电流 Peak collector current	t_P=1ms	1640	A
P_{max}	晶体管部分最大损耗 Max. transistor power dissipation	T_{vj} = 175°C, T_C = 25 °C	1111	W
I^2t	二极管 I^2t 值 Diode I^2t	V_R =0V, t_P = 10ms, T_{vj} = 150 °C	14.4	kA^2s
V_{isol}	绝缘电压(模块) Isolation voltage – per module	短接所有端子，端子与基板间施加电压 (Commoned terminals to baseplate), AC RMS,1 min, 50Hz,T_C= 25 °C	2500	V

热和机械数据 Thermal & Mechanical Data

参数 Symbol	说明 Explanation	值 Value	单位 Unit
爬电距离 Creepage distance	端子-散热器 Terminal to heatsink	9	mm
	端子-端子 Terminal to terminal	9	mm
绝缘间隙 Clearance	端子-散热器 Terminal to heatsink	4.5	mm
	端子-端子 Terminal to terminal	4.5	mm
相对漏电起痕指数 CTI (Comparative tracking index)		＞200	

热和机械数据 Thermal & Mechanical Data

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$R_{th(J-F)\ IGBT}$	IGBT 热阻 Thermal resistance – IGBT	冷却液：50%乙二醇溶液；△V/△t=10 dm^3/min；T_F = 75 °C Cooling Fluid：50% water / 50% ethylenglycol；△V/△t=10 dm^3/min；T_F= 75 °C		115	135	K / kW
$R_{th(J-F)\ Diode}$	二极管热阻 Thermal resistance – Diode			160	180	K / kW
△P	冷却液流阻 Pressure drop in cooling circuit	冷却液：50%乙二醇溶液；△V/△t=10 dm^3/min；T_F = 25 °C Cooling Fluid：50% water / 50% ethylenglycol；△V/△t=10 dm^3/min；T_F= 25 °C		68		mbar
P	冷却液最大压力 Maximum pressure in cooling circuit				2	bar
$T_{vj\ op}$	工作结温 Operating junction temperature	IGBT 部分（IGBT）	-40 150		150 175	°C
		二极管部分(Diode)	-40 150		150 175	°C
T_{stg}	存储温度 Storage temperature range		-40		125	°C
M	安装力矩 Screw torque	安装紧固用 - M4 Mounting – M4	1.8	2.0	2.2	Nm
		PCB 安装用 PCB Mounting	0.55	0.6	0.65	Nm

热敏电阻数据 NTC-Thermistor Data

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
R_{25}	额定电阻值 Rated resistance	T_C = 25 °C		5		kΩ
△R/R	R_{100} 偏差 Deviation of R_{100}	T_C = 100 °C, R_{100}=493Ω	-5		5	%
P_{25}	耗散功率 Power dissipation	T_C = 25 °C			20	mW
$B_{25/50}$	B -值 B -value	$R_2 = R_{25} \exp [B_{25/50}(1/T_2 - 1/(298.15\ K))]$		3375		K
$B_{25/80}$	B -值 B -value	$R_2 = R_{25} \exp [B_{25/80}(1/T_2 - 1/(298.15\ K))]$		3411		K
$B_{25/100}$	B -值 B -value	$R_2 = R_{25} \exp [B_{25/100}(1/T_2 - 1/(298.15\ K))]$		3433		K

电特性值 Electrical Characteristics

除非特别声明，否则 T_C= 25 °C　　T_C= 25 °C unless otherwise stated

符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
I_{CES}	集电极截止电流 Collector cut-off current	V_{GE} = 0V,V_{CE} = V_{CES}			1	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C=150 °C			10	mA
		V_{GE} = 0V, V_{CE} = V_{CES}, T_C=175 °C			15	mA
I_{GES}	栅极漏电流 Gate leakage current	V_{GE} = ±20V, V_{CE} = 0V			0.5	μA
$V_{GE\ (TH)}$	栅极-发射极阈值电压 Gate threshold voltage	I_C = 15mA, V_{GE} = V_{CE}	5.30	5.90	6.50	V
$V_{CE\ (sat)}$ (*1)	集电极-发射极饱和电压 Collector-emitter saturation voltage	V_{GE} =15V, I_C = 450A		1.25	1.55	V
		V_{GE} =15V, I_C = 450A,T_{vj} = 150 °C		1.30		V
		V_{GE} =15V, I_C = 450A,T_{vj} = 175 °C		1.30		V
		V_{GE} =15V, I_C = 820A		1.60		V
I_F	二极管正向直流电流 Diode forward current	DC		450		A
	二极管额定正向电流 Diode ratingforward current			820		A
I_{FRM}	二极管正向重复峰值电流 Diode peak forward current	t_P = 1ms		1640		A
V_F (*1)	二极管正向电压 Diode forward voltage	I_F = 450A, V_{GE} = 0		1.65	1.95	V
		I_F = 450A, V_{GE} = 0, T_{vj} = 150 °C		1.65		V
		I_F = 450A, V_{GE} = 0, T_{vj} = 175 °C		1.65		V
		I_F = 820A, V_{GE} = 0		2.05		V
I_{SC}	短路电流 Short circuit current	T_{vj} = 150°C, V_{CC} =400V, V_{GE}≤15V, t_p≤6μs, $V_{CE(max)}$ = V_{CES} – $L^{(*2)}$×di/dt, IEC 6074-9		3800		A

注意： 1.(*1) 表示该参数的测试点为辅助母排端子((*1) indicates it is measured at the auxiliary busbar terminal),

Note: 2.(*2) 表示 L 是电路杂散电感加上 L_M((*2) indicates L is the circuit stray inductance plus L_M).

电特性值 Electrical Characteristics

除非特别声明，否则 T_C= 25 °C　　T_C= 25 °C unless otherwise stated

符号 Symbol	参数名称 Parameter	条件 Test Conditions	最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
C_{ies}	输入电容 Input capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		74		nF
Q_g	栅极电荷 Gate charge	±15V		4.20		μC
C_{res}	反向传输电容 Reverse transfer capacitance	V_{CE} = 25V, V_{GE} = 0V, f = 100kHz		0.29		nF
L_M	模块电感 Module inductance			8		nH
R_{INT}	内阻 Internal transistor resistance			0.5		mΩ

电特性值 Electrical Characteristics

符号 Symbol	参数名称 Parameter	测试条件 Test Conditions		最小值 Min.	典型值 Typ.	最大值 Max.	单位 Unit
$t_{d(off)}$	关断延迟时间 Turn-off delay time	I_C =450A, V_{CE} = 400V, V_{GE} = ±15V, $R_{G(OFF)}$ = 5.1Ω, L_S = 55nH, dv/dt =4400V/us (T_{vj}= 150 °C).	T_{vj}= 25 °C		1065		ns
			T_{vj}= 150 °C		1080		
			T_{vj}= 175 °C		1095		
t_f	下降时间 Fall time		T_{vj}= 25 °C		80		ns
			T_{vj}= 150 °C		85		
			T_{vj}= 175 °C		90		
E_{OFF}	关断损耗 Turn-off energy loss		T_{vj}= 25 °C		33		mJ
			T_{vj}= 150 °C		36		
			T_{vj}= 175 °C		37		
$t_{d(on)}$	开通延迟时间 Turn-on delay time	I_C =450A, V_{CE} = 400V, V_{GE} = ±15V, $R_{G(ON)}$ = 2.4Ω, L_S = 55nH, di/dt = 5400A/us (T_{vj}= 150 °C).	T_{vj}= 25 °C		845		ns
			T_{vj}= 150 °C		850		
			T_{vj}= 175 °C		855		
t_r	上升时间 Rise time		T_{vj}= 25 °C		87		ns
			T_{vj}= 150 °C		105		
			T_{vj}= 175 °C		105		
E_{ON}	开通损耗 Turn-on energy loss		T_{vj}= 25 °C		10.0		mJ
			T_{vj}= 150 °C		10.5		
			T_{vj}= 175 °C		11.0		
Q_{rr}	二极管反向恢复电荷 Diode reverse recovery charge	I_F =450A, V_{CE} = 400V, - di_F/dt = 5400A/us (T_{vj}= 150 °C).	T_{vj}= 25 °C		47		μC
			T_{vj}= 150 °C		52		
			T_{vj}= 175 °C		57		
I_{rr}	二极管反向恢复电流 Diode reverse recovery current		T_{vj}= 25 °C		320		A
			T_{vj}= 150 °C		335		
			T_{vj}= 175 °C		345		
E_{rec}	二极管反向恢复损耗 Diode reverse recovery energy		T_{vj}= 25 °C		15.5		mJ
			T_{vj}= 150 °C		17.0		
			T_{vj}= 175 °C		18.5		

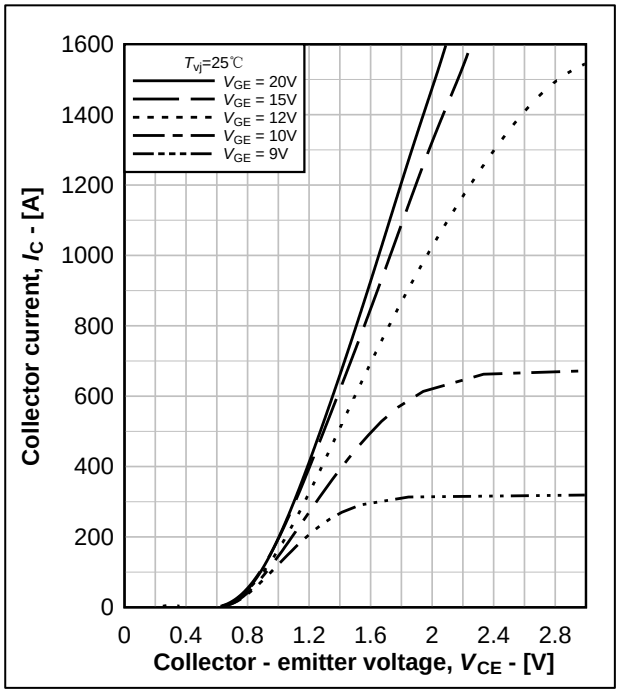


图 3. IGBT 输出特性典型曲线,I_C= f (V_{CE})

Fig.3 Typical IGBT output characteristics, I_C= f (V_{CE})

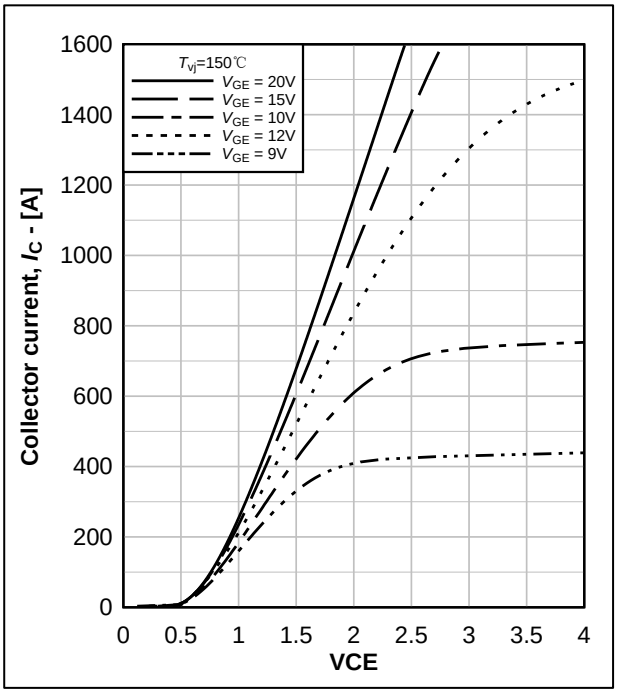


图 4. IGBT 输出特性典型曲线,I_C= f (V_{CE})

Fig.4 Typical IGBT output characteristics, I_C= f (V_{CE})

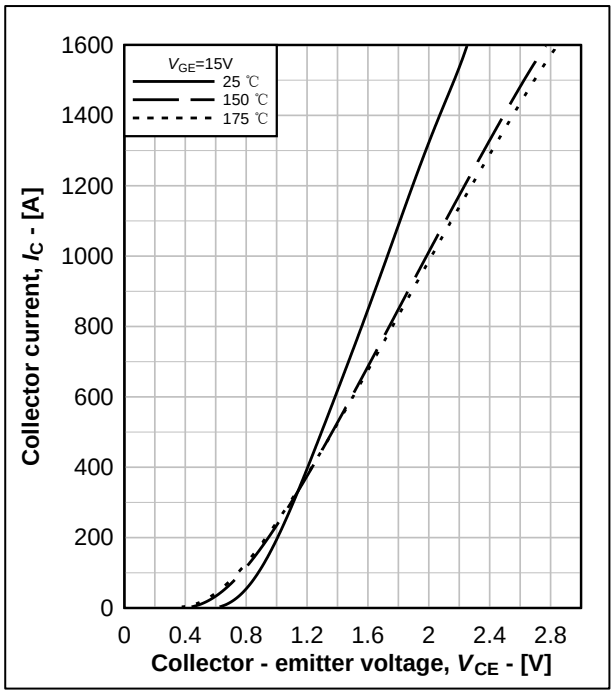


图 5. IGBT 输出特性典型曲线,I_C= f (V_{CE})

Fig.5 Typical IGBT output characteristics, I_C= f (V_{CE})

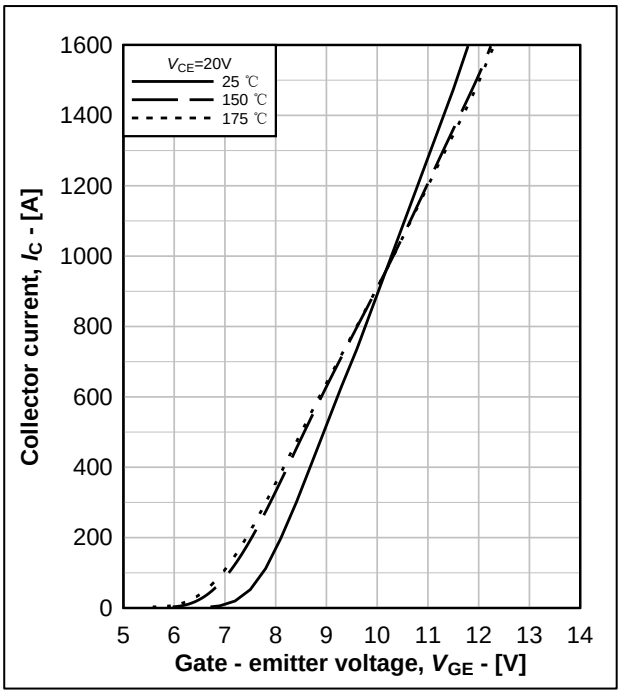


图 6. IGBT 传输特性典型曲线,I_C= f (V_{GE})

Fig.6 Typical IGBT transfer characteristics, I_C= f (V_{GE})

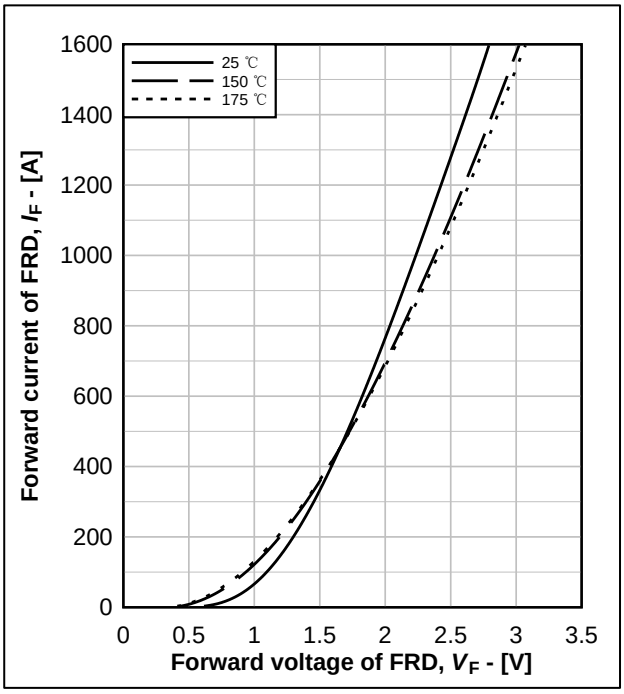


图 7. FRD 输出特性典型曲,I_F = f (V_F)

Fig.7 Typical FRD output characteristics, I_F = f (V_F)

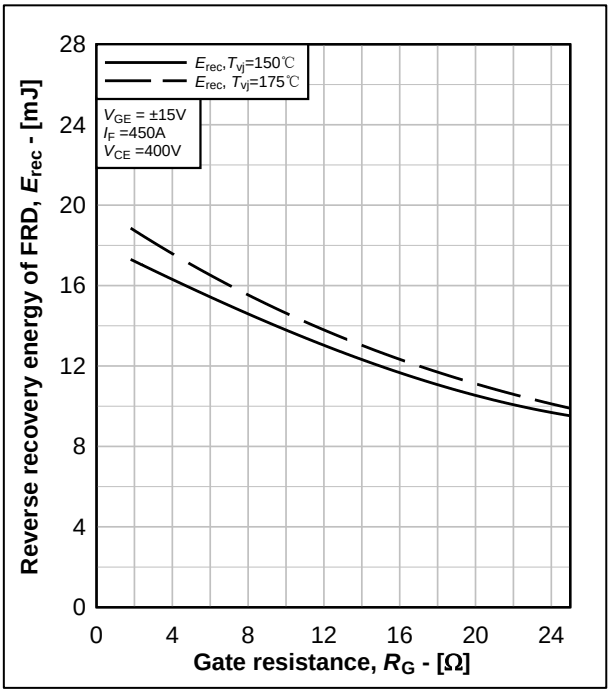


图 8. FRD 反向恢复能耗典型曲线,E_{rec}=f(R_G)

Fig.8 Typical FRD E_{rec}, E_{rec}=f(R_G)

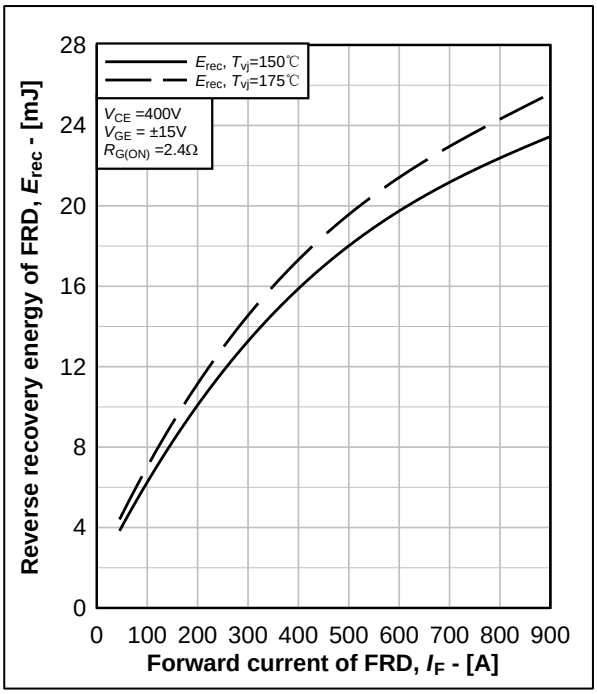


图 9. FRD 反向恢复能耗典型曲线,E_{rec}=f(I_F)

Fig.9 Typical FRD E_{rec}, E_{rec}=f(I_F)

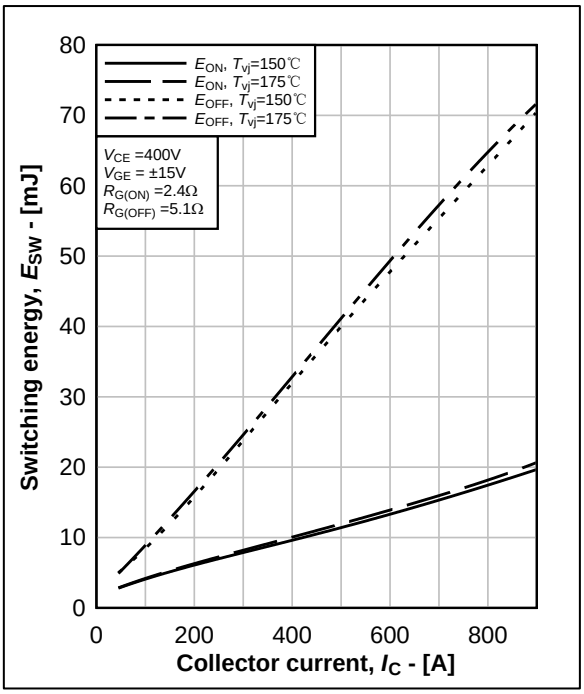


图 10. IGBT 开关能耗典型曲线,E_{on}= f (I_C), E_{off}= f (I_C)

Fig.10 Typical IGBT switching energy, E_{on}= f (I_C), E_{off}= f (I_C)

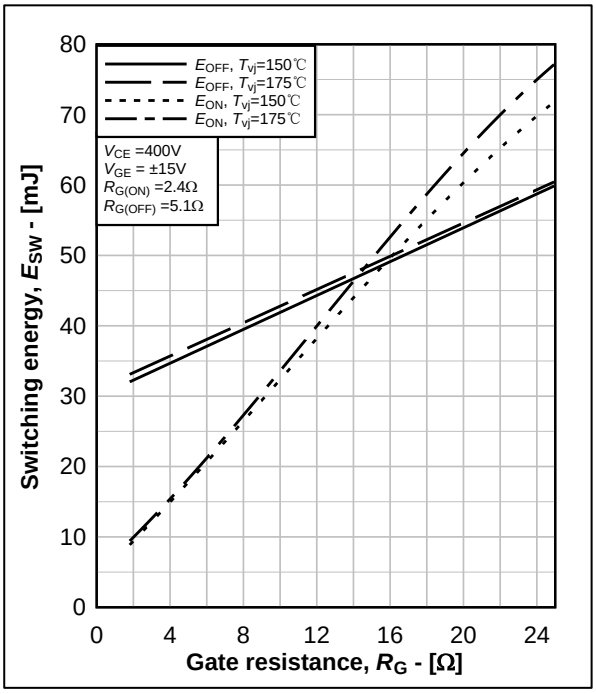


图 11. IGBT 开关能耗典型曲线,E_{on}= f (R_G), E_{off}= f (R_G)

Fig.11 Typical IGBT switching energy, E_{on}= f(R_G), E_{off}= f (R_G)

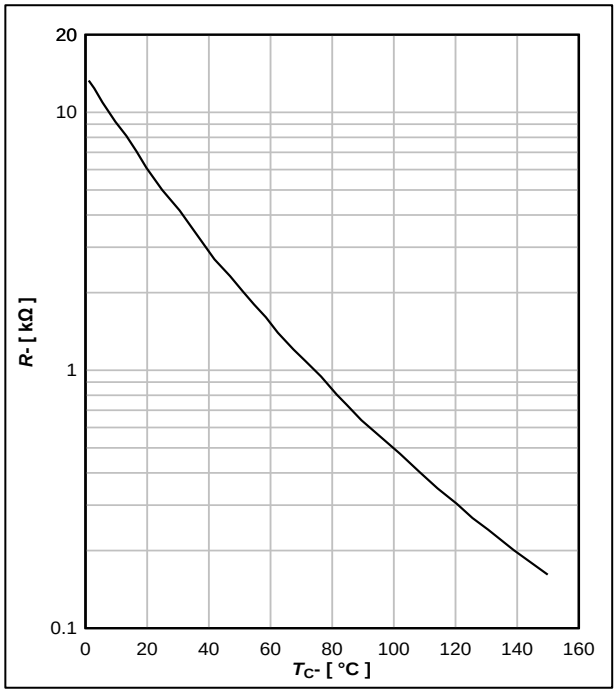


图 12. 热敏电阻典型特性曲线,R= f (T_C)

Fig.12Typical NTC thermistor characteristic, R= f(T_C)

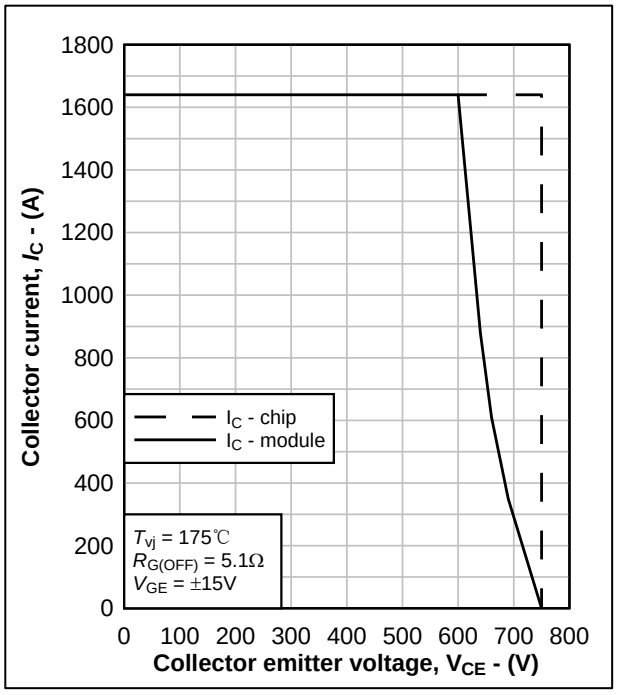


图 13. IGBT 反偏安全工作区,I_C = f (V_{CE})

Fig.13 Reverse bias safe operating area of IGBT, I_C = f (V_{CE})

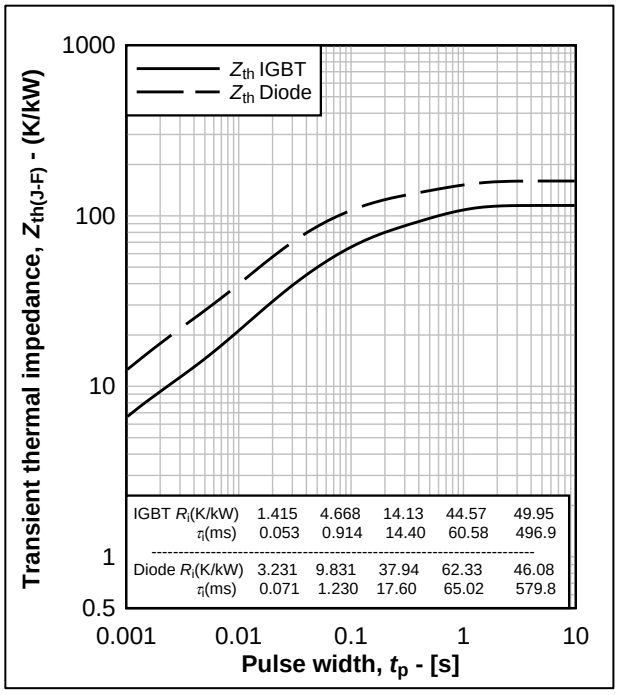
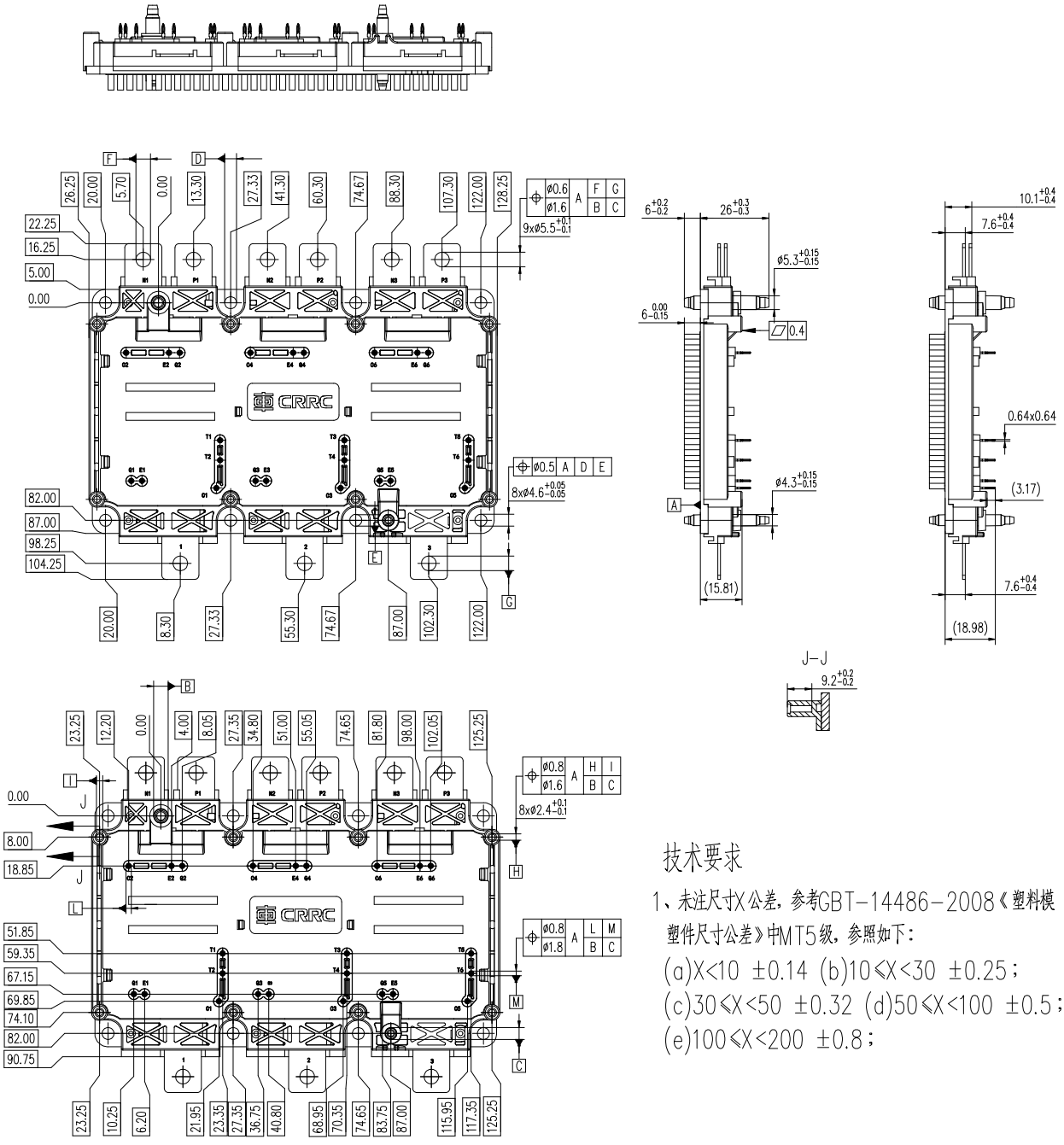


图 14. 瞬态热阻抗曲线,$Z_{th(J-F)}$ = f (t_p)

Fig.14 Transient thermal impedance,$Z_{th(J-F)}$ = f (t_p)



重量 Weight：735g 模块外观类型 Module outline code：S3

图 15. 模块外观尺寸

Fig. 15 Module outlines

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